



10-acre facultative lagoon system, prior to wetland cells



Portion of wetland cell with some plant die-off



Wetland cell

Avondale Facility Statistics	
Nearest Town:	Avondale
County:	Pueblo
River Basin:	Middle Arkansas
Receiving Water Body:	Green Arroyo
Year Online:	1996
Population:	1,000
Elevation (feet):	4560
Design Flow (mgd):	0.110
Average Flow (mgd):	0.080
Size (acres):	0.87

Facility Description

The Avondale Wastewater treatment facility is a minor municipal lagoon system. The facility consists of a continuous influent flow measuring device and recorder, a lagoon system, three wetland cells, a chlorine contact chamber, and a continuous effluent flow measuring device and recorder.

The permitted design capacity of the Avondale Wastewater Facility is 0.1146 million gallons per day for hydraulic flow (30-day average) and 211lbs. BOD₅ per day for organic loading (30-day average).

Lagoons

The Avondale lagoon system consists of 2 unaerated cells. Some of the system features are detailed in the table below.

Lagoon Information		
Cell No.:	1	2
Surface Area (sq. ft.)	217,800	217,800
Avg. Depth (ft)	5	5
Avg. Volume (Million gallons)	7.5	7.5
Detention time (days)	90	90
Aerator size (hp)	NA	NA

Background Information

On April 30, 1993 the Water Quality Control Division issued a Notice of Violation and Cease and Desist Order (NOVCDO) to the District as a result of non-compliance with the permit for the Wastewater Treatment Facility. On February 1, 1995, the NOVCDO was amended requiring the District to complete construction of a facility upgrade and planting of the wetland portion of the facility. The deadline established for completion of construction and planting was November 30, 1995. In late November 1995, the District notified CDPHE that the upgrade was completed except for the wetland planting which would be delayed until spring, 1996. This system has continued to have problems meeting permit limitation, even after the wetland implementation. At the time of the site visit, this facility was not discharging.

Energy Analysis

The Avondale system is an unaerated facultative lagoon system. Energy consumption at this site is negligible.

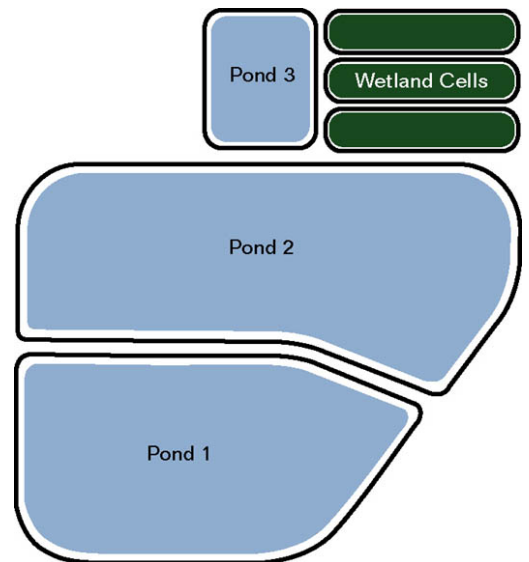
Wetland Design

Design Methods

The FWS wetlands were sized using first order plug flow kinetics for BOD removal. The average loading for each wetland cell was calculated to be 11.2 acre per mgd, with a detention time of 4.1 days. The summer loading rate was calculated to be 28.3 acre per mgd, with a detention time of 3.4 days.

Objectives

The FWS wetland cells were added to polish the effluent from the lagoon system. Compliance issues were a result of algae carryover from the lagoon system.



Size

The individual area for the three wetland cells is approximately 12,750 ft² for a total area of 38,250 ft².

Shape

As the schematic to the right shows, Avondale constructed wetland cells are flat and rectangular, with an area of approximately 0.3 acres each.

Hydraulics

Wetland cells are lined with 3" of bentonite clay to prevent groundwater influences. The inlet mechanism into the wetland cells consists of slotted pipes buried in a gravel bed with particle sizes ranging from 3" to 6". Plugging of the outlet was noted to be a problem. At the time of the site visit the outlet was not functioning. This system does not have a mechanism for varying water elevation in the wetland.

At the time of the site visit the wetland system was not discharging. The operator was able to bypass the wetland system if the lagoon effluent met discharge requirements. Otherwise, the wetland system operated as an evaporative cell.

Treatment Goals

Permitted Discharge Limitations	
Oil and Grease:	10 mg/l (Daily Max)
CBOD ₅ :	25 mg/l (30-day avg)
BOD ₅ Removal:	85%
TSS:	105 mg/l (30-day avg)
PH, su (min – max)	6.5 – 9.0 (Daily Max)
Chlorine Residual:	0.5 mg/l (Daily Max)
Fecal Coliform Bacteria:	6,000 organisms per 100 ml (Daily Max)

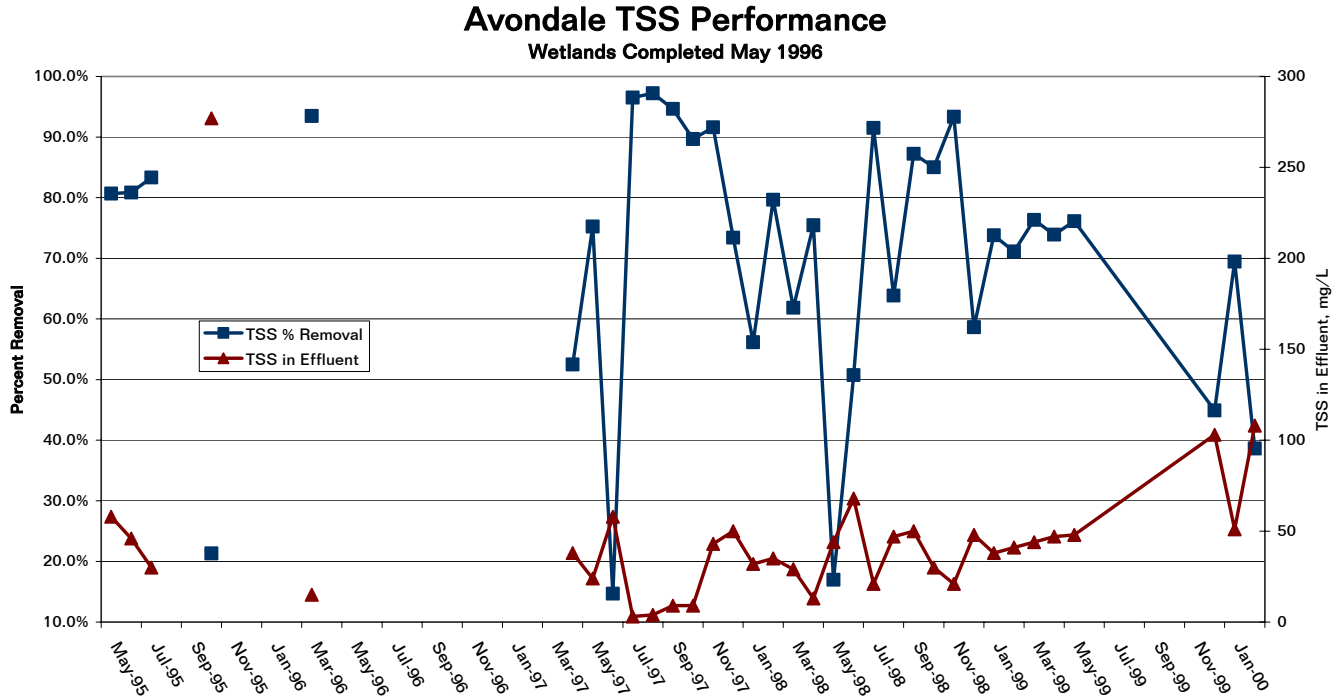
Water Quality Data

Water quality data were obtained from CDPHE permit files. The data indicate that the wetlands have not been able to consistently meet permit.

TSS Data

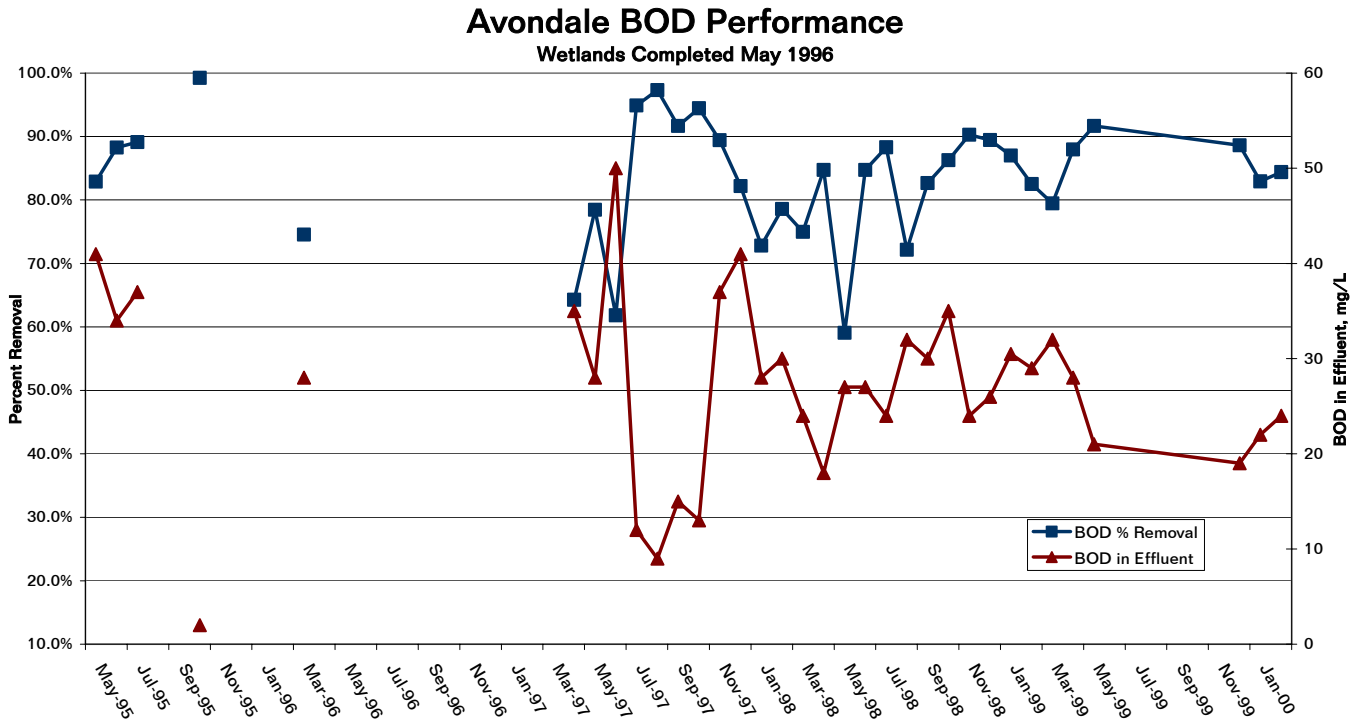
Some general observations can be made by reviewing the plotted 30-day average TSS data. The TSS graph plots the percent removal on the left axis and TSS in mg/l in the effluent on the right axis. In the months before the wetland was implemented, there was no discharge from the treatment facility. Since no discharge

was occurring, data for this period were not reported. Trends in the TSS data indicate that TSS in the effluent has consistently been below permit limitations. The most current data indicate that TSS in the effluent has been increasing, while percent removal in the system has been decreasing.



The discharge permit limitation for TSS in the effluent is 105 mg/l for the 30-day average. Monthly reports submitted to the CDPHE record an average daily TSS in the influent, since the wetlands have been operating, of 165 mg/l. The average TSS in the effluent is recorded to be 40 mg/l. This removal clearly meets the discharge requirements of 105 mg/l.

BOD Data



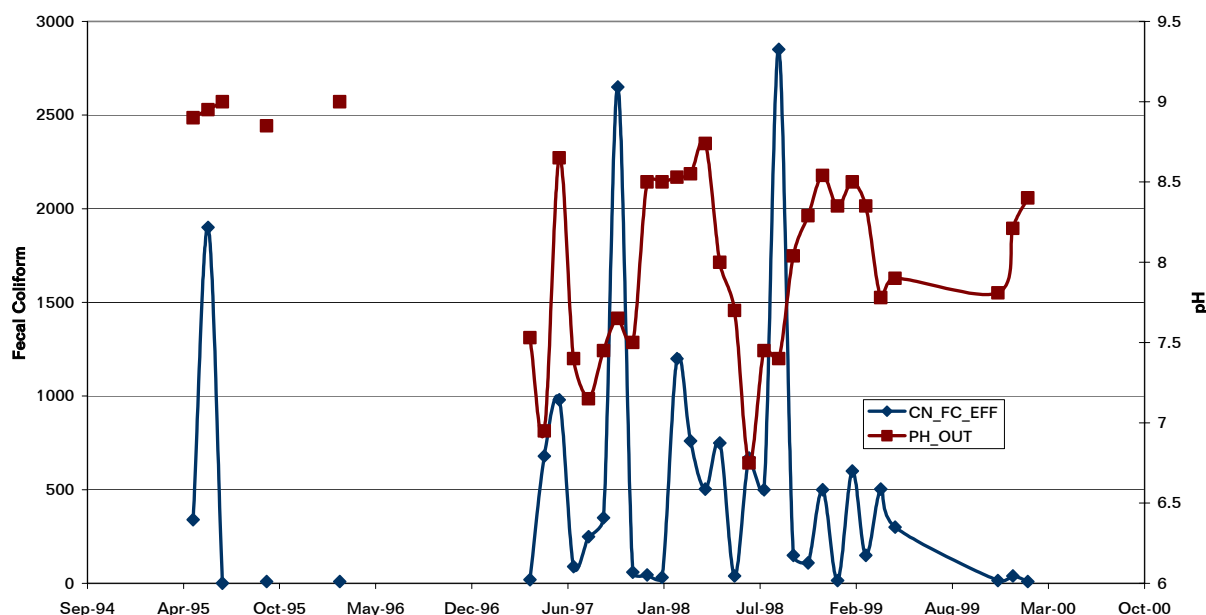
The BOD data is plotted similarly to the TSS data, with mg/l in the effluent on the right axis, and percent removal on the left axis. The data previous to the wetland implementation is scant, as discharge was not occurring during this period. The permit for this system changed from reporting BOD₅ to reporting CBOD₅. Tests indicate that there is little difference between the two at this system. The data from this system indicates that CBOD values have exceeded permit limitations. The average CBOD in the influent, since wetland implementation, has been 185 mg/l, with an average effluent amount of 27 mg/l. This average value is slightly higher than the permitted value of 25 mg/l. The percent removal in the system recorded an average value, during this same period, of 83 percent. This removal is slightly lower than the permitted removal of 85 percent.

pH and Fecal Coliform

Data for these two categories have been plotted on the same graph. Data reflect the quality of the effluent, no influent measurements are taken for these parameters. The pH values plotted are an average of the minimum and maximum 30-day values that are reported in the monthly reports. Previous to the wetland implementation, data indicate that average pH values in the effluent were close to the maximum daily allowable of 9. Since the wetland implementation, pH values have consistently stayed within the allowable range of 6.5 to 9.

Fecal Coliform in the effluent is consistently well below the permit limitations of 6,000 organisms per 100ml.

Avondale pH and FC



General Ecological Setting

The Avondale wetland is located on the north side of the Town of Avondale, on a terrace above the Arkansas River.

Cell Vegetation

Three cells with similar vegetation communities are present at the Avondale site. Cell 1 is composed of 80 percent water, 10 percent litter, and 10 percent vegetation. The vegetation community is dominated by cattail (*Typha latifolia*), duckweed (*Lemna minor*), and algae, with common reedgrass present but not dominant. Tamarisk (*Tamarix chinensis*) and Russian olive (*Eleagnus angustifolia*) are present on the edges of the cell. Cell 2 is 75 percent open water, 5 percent litter, and 20 percent vegetation. The plant community in cell 2 is composed of cattail, duckweed, and barnyard grass (*Echinochloa crus-galli*). Cell 3 is 50 percent open water and 50 percent vegetation. The vegetation community is dominated by cattail, duckweed, common reedgrass (*Phragmites australis*), barnyard grass, and algae.

Planting/Seeding

The wetland was planted with cattail, giant burreed, water lily, dwarf bamboo, duckweed, and yellow water iris. Most planted/seeded species have not survived. The water lily, bamboo, and water iris are not specifically adapted to this area, and probably could not compete with species such as cattail.

Weeds

Tamarisk and Russian olive are present on the edges of cell 1. Tamarisk is a facultative phreatophyte, i.e., it can draw water from underground sources but once established it can survive without access to ground water. It consumes large quantities of water, possibly more than woody native plant species that occupy similar habitats. Tamarisk is a maintenance concern and commonly is controlled in riparian areas and wetlands because of its potential to displace native vegetation and its lower value as wildlife habitat. Russian olive is an introduced ornamental shade tree than can invade waterways and becomes a serious weed problem (Whitson 1996). It provides little value as wildlife habitat.

Wildlife

The Avondale wetland provides habitat for muskrat and snapping turtle. Muskrats have been problematic, causing vegetation damage and clogging outflows. This site contains some structural diversity such as open water mixed with cattail stands; however, some of the open water may be a result of a recent die-off. Also, it should be noted that large areas of open water that lack vegetative cover have lower habitat value.

Wetland Biodiversity Functional Assessment

Sediment/nutrient/toxicant removal rated high. General wildlife habitat and production export/food chain support rated moderate. Habitat diversity and uniqueness of the constructed wetland rated low. This wetland received 40 percent of the total possible functional points.

Wetland Biodiversity Functional Assessment.		
Function and Value Variables	Functional Points (0.1 to 1)	Possible Points
General Wildlife Habitat	0.4 (mod.)	1
General Fish/Aquatic Habitat	0.0	1
Production Export/Food Chain Support	0.6 (mod.)	1
Habitat Diversity	0.2 (low)	1
Uniqueness	0.2 (low)	1
Total Points	2.4 (48%)	5
Wetland Category (I, II, III, or IV)	III	

Human Use

The wastewater wetland is part of a restricted public access area, and has never been used for educational purposes. At the time of the site visit, the aesthetic value of this wetland was low because of recent vegetation die offs. However it has potential to have moderate aesthetic value with viable vegetation.

Maintenance Issues

Wetlands would benefit from either lowering the water level or raising the soil surface. The overall system performance could be improved by incorporating a mechanism to allow the water level in the wetland to be lowered.

Overall Site Comments

The wetlands at this site have not functioned as intended. It is possible that the shallow lagoons are not achieving the treatment anticipated and are therefore overloading the wetland system.